

# The spastic velocity threshold predicts Botulinum toxin-A treatment outcome in the medial hamstrings of children with cerebral palsy

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## Introduction

Data collected using an innovative instrumented spasticity assessment (ISA) in the medial hamstrings (MEH) of children with cerebral palsy (CPC) has revealed a large variability among subjects in the velocity threshold (VT) at which hyperreflexia (spasticity) occurs. Intramuscularly injected Botulinum toxin-A (BTX) temporarily decreases spasticity in the MEH, although a large variability in response is reported.

## Aim

To investigate whether the spastic VT pre-treatment can predict the effect of BTX in the MEH of CPC.

## Method

14 CPC (10±2yrs; 8/6 bilateral/unilateral involvement; GMFCS I-III) were measured pre- and post-BTX with ISA and gait analysis. During ISA, kinematics and electromyography (EMG) were recorded during slow and fast passive MEH stretches. Average normalized root mean square EMG was calculated pre-BTX during slow stretch (pre rms-EMG<sub>slow</sub>) and post-BTX as the change between slow and fast stretch (rms-EMG<sub>post</sub>). Muscles with high pre rms-EMG<sub>slow</sub> values were categorized as low-VT, and those with low pre rms-EMG<sub>slow</sub> values, as high-VT. Using Man-Whitney U tests, rms-EMG<sub>post</sub> and post-BTX improvement in knee extension during terminal swing (Knee<sub>post</sub>) were compared between low-VT and high-VT muscles. The relationships of pre rms-EMG<sub>slow</sub> with rms-EMG<sub>post</sub> and with Knee<sub>post</sub> were investigated using Spearman rank correlation (significance set at p<0.05).

## Results

Rms-EMG<sub>post</sub> was lower (p=0.01) in those muscles categorised pre-BTX as high-VT. There were significant negative correlations for pre rms-EMG<sub>slow</sub> with rms-EMG<sub>post</sub> (r=-0.63, p<0.05) and with Knee<sub>post</sub> (r=-0.48, p<0.05) indicating that muscles with low-VT are less likely to respond to BTX, as assessed both passively and by gait analysis.

## Conclusions

Assessment of the spastic threshold in the MEH in children with CP can be used to choose the most effective management option for the individual patient. The etiology behind the different spastic thresholds requires further investigation.